(12) UK Patent Application (19) GB (11) 2 390 574 (13) A

(43) Date of A Publication 14.01.2004

(21) Application No: 0216038.0

(22) Date of Filing: 10.07.2002

(51) INT CL[7]: B60R 21/16

(52) UK CL (Edition W): B7B BSBCC

(56) Documents Cited:
GB 2241207 A
JP 040260850 A
US 5482317 A
US 5275434 A
JP 070125594 A
JP 040163254 A
US 5423273 A

(58) Field of Search:
UK CL (Edition T) B7B BSBCC BSBCR
INT CL[7] B60R 21/16
Other: ONLINE: WPI, EPODOC, JAPIO

(71) Applicant(s):
Autoliv Development AB
(Incorporated in Sweden)
S-447 83 Vargarda, Sweden

(72) Inventor(s):
Ricardo Soriano
Manuel Vales
Marcus Damm

(74) Agent and/or Address for Service:
Forrester Ketley & Co
Forrester House, 52 Bounds Green Road,
LONDON, N11 2EY, United Kingdom

(54) Abstract Title: **An air bag with two elements having angularly offset warp and weft yarns**

(57) An air bag is disclosed, which is formed from two interconnected elements 3,4 of fabric. Each element can take the form of a regular rectilinear polygon, with square or triangular elements of fabric being preferred. The two elements of fabric are arranged so that the warp and weft yarns of one element 3 of fabric are angularly offset from the warp and weft yarns of the other element 4 of fabric. A preferred embodiment comprises two substantially identical polygonal elements of fabric where the corner regions 5-8 of one said element are interdigitated with the corner regions 9-12 of the other element, and the adjacent peripheral parts of the interdigitated corner regions are interconnected by means of a seam (see figure 3). The construction of the air bag is intended to make more efficient use of the fabric, and also the offset between the yarns of the two elements is intended to provide a desirable inflation characteristic.

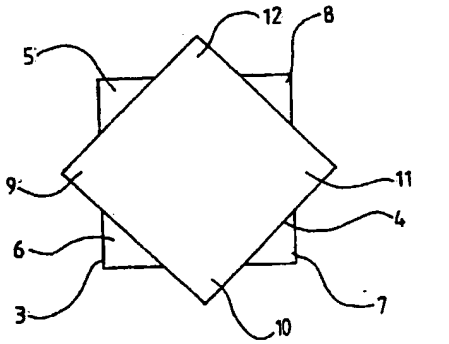

FIG 2

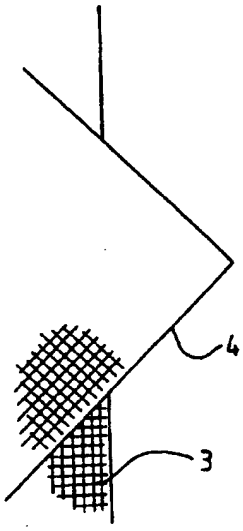

FIG 5

GB 2 390 574 A

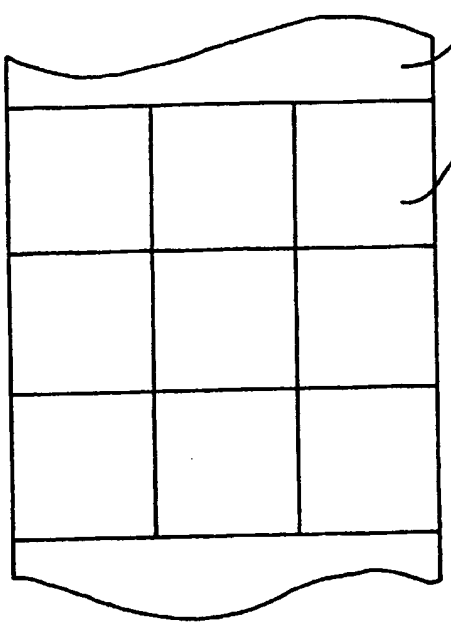

FIG 1

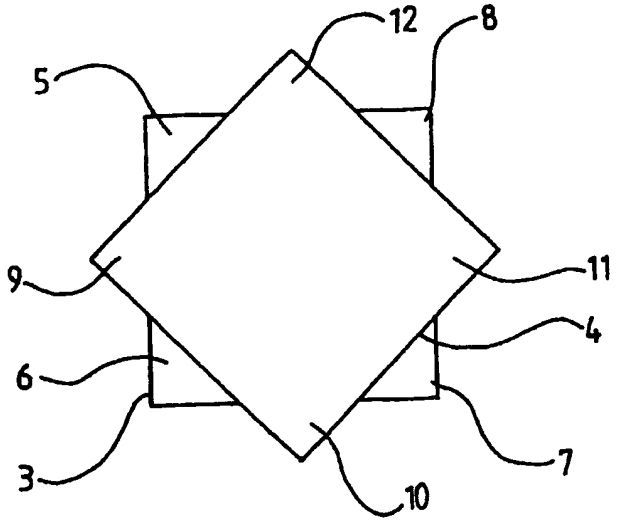

FIG 2

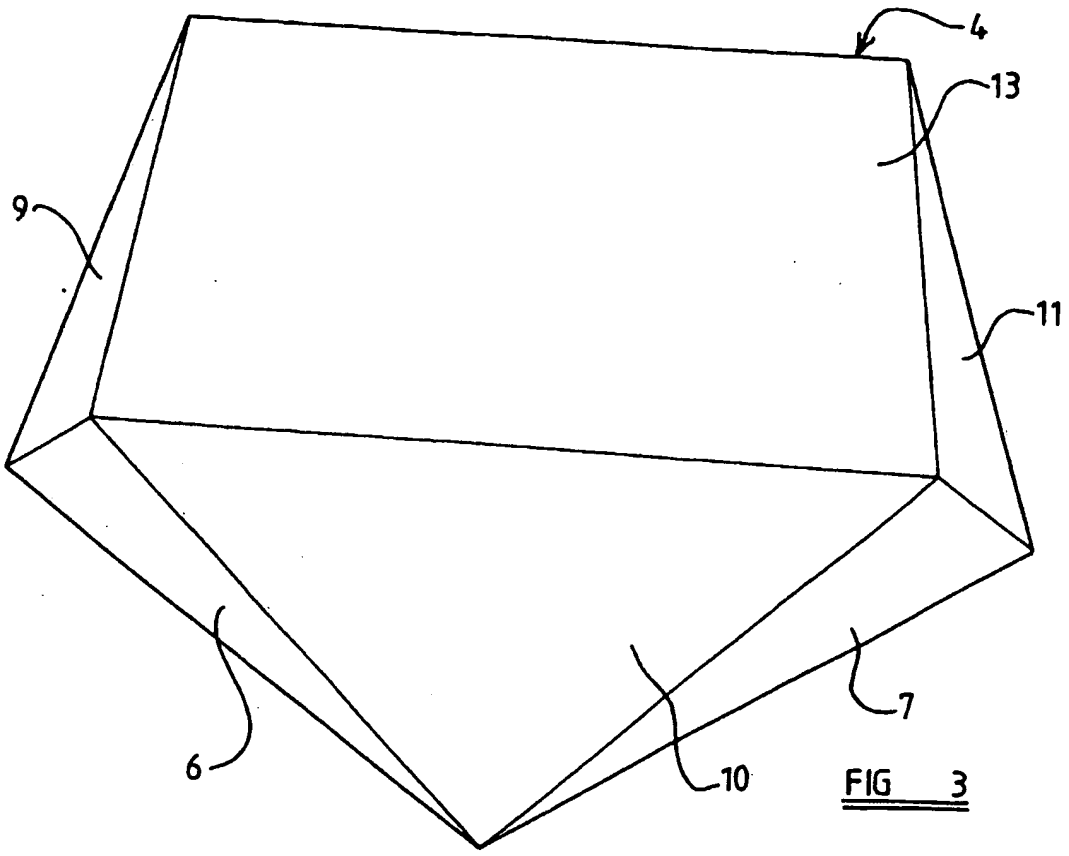

FIG 3

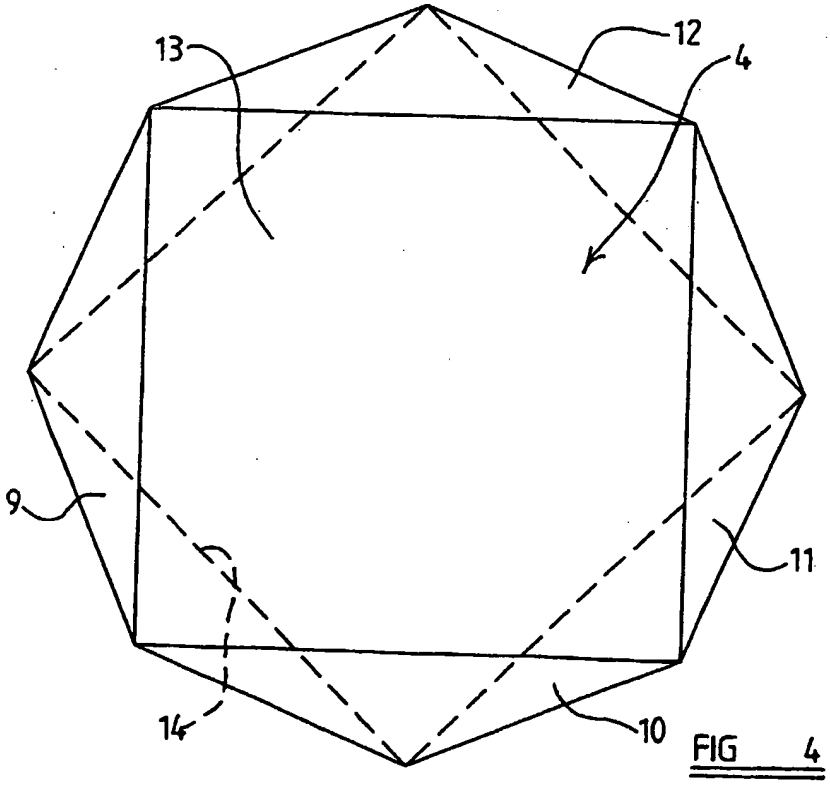

FIG 4

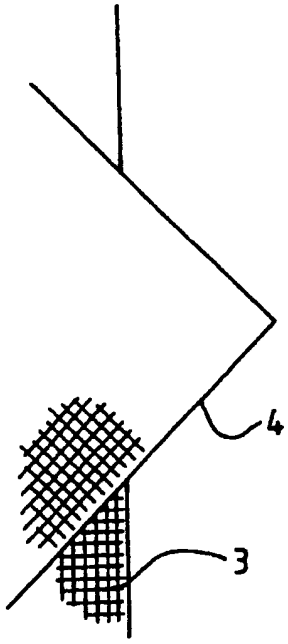

FIG 5

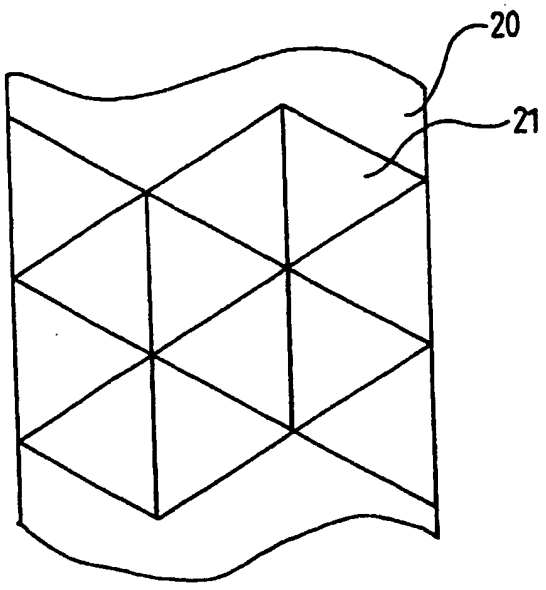

FIG 6

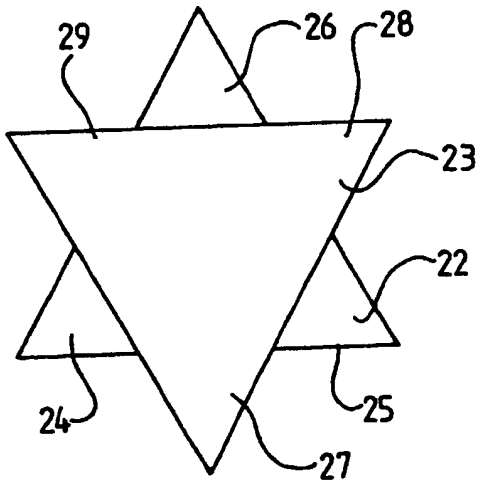

FIG 7

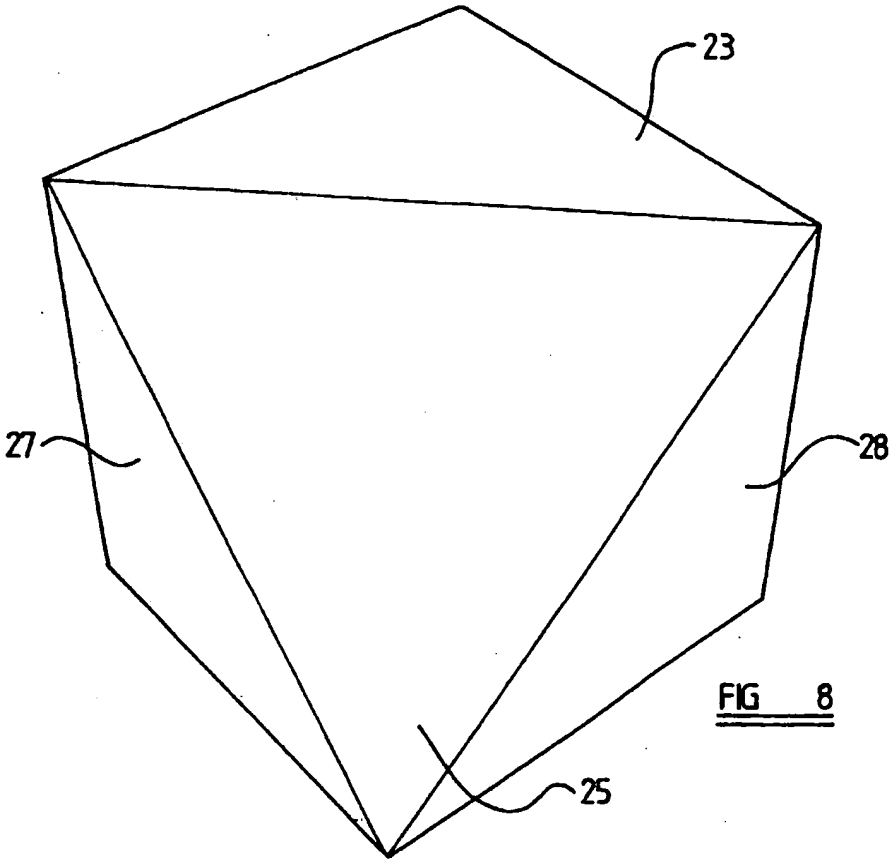

FIG 8

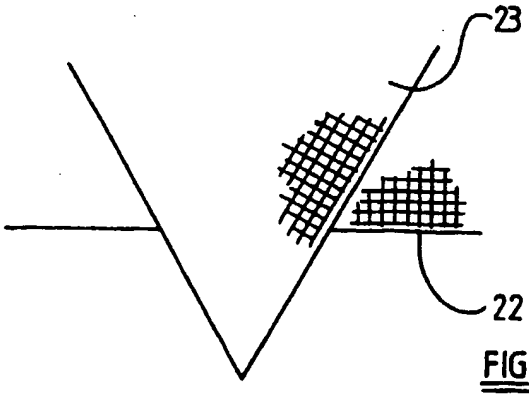

FIG 9

DESCRIPTION OF INVENTION

"IMPROVEMENTS IN OR RELATING TO AN AIR-BAG"

THE PRESENT INVENTION relates to an air-bag, and more particularly relates to an air-bag for use in a motor vehicle to provide protection for an occupant of the vehicle in the event that an accident should occur.

Typically, air-bags are manufactured from pieces of fabric which are cut-out from a larger piece or roll of fabric. If a generally round air-bag is to be manufactured, round pieces of fabric are cut from the larger piece or roll, and consequently there will inevitably be a lot of the original large piece or roll of fabric remaining, which will be "scrap". When manufacturing circular air-bags, such as air-bags to be mounted on the steering wheel of a motor vehicle, it is quite common for between 10-20% of the original large piece, or roll of fabric to be subsequently discarded as scrap. If the shape of the fabric pieces used to make an air-bag could be polygonal, such as square or rectangular, it would be possible to cut the polygonal-shaped pieces from a larger piece, or roll of fabric, leaving only a minimum amount of scrap. However, if two identical polygonally-shaped pieces of fabric are simply super-imposed and sewn together along their periphery, thus forming an air-bag having a front

fabric layer and a rear fabric layer, a polygonal air-bag is manufactured, but, when such an air-bag is inflated, it is found to be generally "flat", and thus may be termed a two-dimensional air-bag. Ideally an air-bag should have substantial "depth", and should thus be a three-dimensional air-bag. If would be possible to add extra pieces of fabric between a front polygonal fabric layer and a rear polygonal fabric layer to provide a three-dimensional air-bag, but this may increase the scrap rate, and also increases manufacturing complexity.

The present invention seeks to provide an improved air-bag.

According to a first aspect of the present invention, there is provided an air-bag, the air-bag being formed from two interconnected elements of fabric, the warp and weft yarns of one element of fabric being angularly off-set from the warp and weft yarns of the other element of fabric.

Preferably, the angle of off-set is between 25° and 65°.

Advantageously, the angle of off-set is 60°.

Conveniently, the angle of off-set is 45 °.

Preferably, the air-bag is formed from two substantially identical polygonal elements of fabric, the corner regions of one element being interdigitated with the corner regions of the other element, the adjacent peripheral parts of the interdigitated corner regions being interconnected by means of a seam.

According to another aspect of the present invention, there is provided an air-bag formed from two substantially identical polygonal elements of fabric,

the corner regions of one said element being interdigitated with the corner regions of the other element, the adjacent peripheral parts of the interdigitated corner regions being interconnected by means of a seam.

Preferably, each polygonal element takes the shape of a regular rectilinear polygonal.

Advantageously, each polygonal element is square in shape.

Conveniently, each polygonal element is triangular in shape.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic view of a roll of fabric, with smaller fabric elements being cut therefrom,

FIGURE 2 is a view of two super-imposed fabric elements cut from the roll of fabric illustrated in Figure 1.

FIGURE 3 is a perspective view of an air-bag in the inflated state illustrating the relative positions of parts of the two fabric elements shown in Figure 2,

FIGURE 4 is a top plan view of the air-bag of Figure 3,

FIGURE 5 is an enlarged view corresponding to part of Figure 2,

FIGURE 6 is a view corresponding to Figure 1 illustrating a roll of fabric used in an alternative embodiment of the invention,

FIGURE 7 is a view illustrating two superimposed elements of fabric taken from the roll shown in Figure 6 in the assembling of an air-bag,

FIGURE 8 is a perspective view of an air-bag made from the two elements of fabric shown in Figure 7, and

FIGURE 9 is an enlarged view of part of Figure 7.

Referring initially to Figure 1 of the accompanying drawings, a large piece or roll of fabric 1 is shown. The roll or piece of fabric 1 is cut, for example using a laser cutting technique, into a plurality of separate fabric elements 2. In the illustrated embodiment the fabric elements 2 are each regular rectilinear polygons having four sides, and in the specific example shown, the polygons are squares. Thus the roll or piece of fabric 1 is to cut into a plurality of square elements 2. This can be achieved with minimum wastage or scrap.

As shown in Figure 2, a first square element 3 cut from the roll of price of fabric 1 is initially located in position, and then a second square element 4, which is of the same size and shape as the first square element 3, is located in position on top of the first square element 3. The second square element 4 is, however, not co-aligned with the first square element 3, but instead is rotated, relative to the first square element 3 by a predetermined angle which, in the described embodiment, is 45°. The lower first square element 3 thus now has

four corner regions 5, 6, 7, 8 which project beyond the periphery of the upper second square element 4. Similarly the upper second square element 4 has four corner regions 9, 10, 11, 12 which extend beyond the periphery of the lower first square element 3.

The corner regions 5, 6, 7, 8 of the lower square element 3 are then effectively folded upwardly, and the corner regions 9, 10, 11, 12 of the upper square element 4 are effectively folded downwardly. Thus the four corner regions 5, 6, 7, 8 of the lower element of fabric 3 become interdigitated with the four corner regions 9, 10, 11, 12 of the upper layer of fabric 4. The corner point of each corner region 5, 6, 7, 8 of the lower element 3 touches the mid-point of a respective side edge of the upper square element 4. Similarly, the corner point of each corner region 9, 10, 11, 12 of the upper square element touches the mid-point of a respective side edge of the lower square element 3.

The corner regions are each of triangular form, and the corner regions of the lower square element 3, after they have been folded as explained above, leave a remaining square area 13 of fabric, having an area smaller than that of the entire lower square element, as shown clearly in Figure 4. Similarly, the corner regions of the upper square element 4 leave a remaining square area 14 of fabric. The adjacent edges of the interdigitated corner regions of the two elements of fabric 3, 4 are then sewn together to form a peripheral zig-zag seam.

The fabricated bag then has the appearance of that shown in Figure 3 where the remaining square area of the upper fabric element 4 can be seen with the corner regions 10 and 11. Received between the corner regions 10 and 11 is the corner region 7 of the lower fabric element 3, and received between the corner regions 9 and 10 of the upper element is the corner region 6 of the lower

fabric element 3. Figure 4 shows the completed air-bag from above, and here it can be seen that the remaining square region of the lower sheet of fabric, indicated in phantom as region 14, is 45° off-set from the remaining square region 13 of the upper layer of fabric 4.

As can be seen from Figure 5, when the square fabric layers 3,4 are super-imposed, the warp and weft yarns (indicated schematically) of the upper layer of fabric 4 are angularly off-set from the warp and weft yarns of the lower layer of fabric 3. Thus the yarns of the two fabric elements 3, 4 are not mutually co-aligned, but instead the yarns of the upper layer of fabric 4 are inclined at a predetermined angle (in this example 45°) relative to the yarns of the lower layer 3 of fabric. It has been found that this off-set, or inclination of the warp and weft yarns provides a desirable inflation characteristic.

The seam which interconnects the interdigitated corner regions of the two elements 3, 4 of fabric has a greater length, because of its zig-zag form, than the length of the seam provided on a conventional two-dimensional air-bag of the same volume. Deployment stresses are thus distributed over a longer seam which serves to enhance the integrity of the seam.

Turning now to Figures 6 to 8, an alternative embodiment of the invention is illustrated in which triangular elements of fabric are used instead of square ones. Figure 6 illustrates the large piece or roll 20 of fabric from which a plurality of triangular fabric elements 21 are being cut, for example by means of a laser technique. The triangular fabric elements 21 are each of equilateral triangular form. Two triangular elements 22, 23 cut from the roll 20 may be super-imposed, as shown in Figure 7, so that the corner regions 24, 25, 26 of the lower triangular element 22 will project beyond the periphery of the upper triangular element 23, and similarly the corner regions 27, 28, 29 of the upper

triangular element 23 will project beyond the periphery of the lower triangular element 22.

The projecting corner regions 24, 25, 26 of the lower triangular element 22 are folded upwardly, and the projecting corner regions 27, 28, 29 of the upper triangular element 23 are folded downwardly. The corner elements are effectively folded until there is a remaining triangular area on the upper triangular element 23 and a remaining triangular area on the lower triangular element 22. The corner regions are then interdigitated and interconnected by a zig-zag seam in a similar manner as described above in connection with the embodiment of Figures 1 to 5.

Figure 8 illustrates the completed air-bag, showing the remaining triangular part of the upper fabric layer 23 with the depending corner regions 27 and 28, which receive between them the corner region 25 of the lower element 22.

Figure 9 shows quite clearly that the warp and weft yarns of the upper layer of fabric 22 are again angularly off-set, this time by 60°, relative to the warp and weft yarns of the lower layer of fabric 22. This again has been found to provide a desirable inflation characteristic.

Whilst the invention has been described with reference to square and triangular elements of fabric, other shaped elements of fabric may be used in other embodiments of the invention. It will therefore be appreciated that whilst the embodiment comprising square elements of fabric results in a yarn off-set angle of 45°, and the embodiment comprising triangular elements of fabric results in a yarn off-set angle of 60°, other shaped elements of fabric will result

in other off-set angles. It has been found that a yarn off-set angle of between 25° and 65° offers desirable inflation characteristics.

In the present Specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

1. An air-bag, the air-bag being formed from two interconnected elements of fabric, the warp and weft yarns of one element of fabric being angularly off-set from the warp and weft yarns of the other element of fabric.

2. An air-bag according to Claim 1 wherein the angle of off-set is between 25° and 65°.

3. An air-bag according to Claim 2 wherein the angle of off-set is 60°.

4. An air-bag according to Claim 2 wherein the angle of off-set is 45°.

5. An air-bag according to any one of the preceding Claims formed from two substantially identical polygonal elements of fabric, the corner regions of one element being interdigitated with the corner regions of the other element, the adjacent peripheral parts of the interdigitated corner regions being interconnected by means of a seam.

6. An air-bag formed from two substantially identical polygonal elements of fabric, the corner regions of one said element being interdigitated with the corner regions of the other element, the adjacent peripheral parts of the interdigitated corner regions being interconnected by means of a seam.

7. An air-bag according to Claim 5 or 6 wherein each polygonal element takes the shape of a regular rectilinear polygon.

8. An air-bag according to Claim 7 wherein each polygonal element is square in shape.

9. An air-bag according to Claim 7 wherein each polygonal element is triangular in shape.

10. An air-bag substantially as herein described with reference to and as shown in Figures 1 to 5 of the accompanying drawings.

11. An air-bag substantially as herein described with reference to and as shown in Figures 1 to 6 of the accompanying drawings.

12. Any novel feature or combination of features disclosed herein.

The Patent Office

INVESTOR IN PEOPLE

Application No: GB 0216038.0
Claims searched: 1 to 9

Examiner: Peter Gardiner
Date of search: 18 October 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): B7B: BSBCC, BSBCR

Int Cl (Ed.7): B60R: 21/16

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2241207 A	TAKATA (see figure 1A and page 3 line 32 to page 4 line 4)	1-4
X	JP 07-0125594 A	TOYO TIRE & RUBBER (see the abstract and figures)	1-4
X	JP 04-0260850 A	NISSAN (see the abstract and figures 1 and 4)	1-4
X	JP 04-0163254 A	IKEDA (see the abstract and figures 1 and 4)	1-4
A	US 5482317	SANDIA (see the whole docuement	
A	US 5423273	GMC (see the whole document)	
X	US 5275434	NISSAN (see the whole document)	1-4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application